

5.3 Mendelian Genetics

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

KEY WORDS phenotype 表现型 • genotype 基因型 • recessive 隐性 • dominant 显性
• alleles 等位基因

Objective

Build the skills to answer exam questions on **Mendelian genetics** — monohybrid crosses.

You must be able to:

- use **dominant** 显性 and **recessive** 隐性 alleles
- complete a **Punnett square** 庞纳特方格
- predict **genotype** 基因型 and **phenotype** 表现型 ratios

1 Worked examples

Study these first. Each one shows the method for a question type used later — follow the steps and you can do the Practice and Exam-style questions yourself.

■ **Alleles and dominance**

A **dominant** allele (capital, e.g. *A*) is expressed even with one copy; a **recessive** allele (*a*) is expressed only when **both** copies are recessive (*aa*).

■ **The Punnett square**

A **Punnett square** predicts offspring by crossing the parents' alleles. For *Aa* × *Aa*:

	A	a
A	AA	Aa
a	Aa	aa

Genotypes: 1 *AA* : 2 *Aa* : 1 *aa*. Phenotypes: **3 dominant** : **1 recessive**.

■ **Genotype vs phenotype**

- **Genotype** — the alleles present (*AA*, *Aa*, *aa*).
- **Phenotype** — the observable trait (dominant or recessive appearance).

■ **A test cross**

Crossing an unknown dominant (*A*_) with *aa*: if any recessive offspring appear, the unknown was *Aa*.

2 Practice

Now apply the methods above.

2.1 How many recessive alleles are needed to show a recessive trait? [1]

2.2 For *Aa* × *Aa*, state the phenotype ratio. [1]

2.3 What is the difference between genotype and phenotype? [1]

3 Exam-style questions

3.1 A cross *Aa* × *Aa* gives a phenotype ratio of [1]

- **A** 1:1
- **B** 3:1
- **C** 9:3:3:1
- **D** all dominant

3.2 In pea plants, tall (*T*) is dominant to short (*t*). Cross *Tt* × *tt*.

(a) Complete a Punnett square. [2]

(b) State the genotype and phenotype ratios. [2]

3.3 A tall plant of unknown genotype is crossed with a short plant, and some short offspring appear. State the tall parent's genotype, with a reason. [2]

Solutions

2.1 Two.

2.2 3 dominant : 1 recessive.

2.3 Genotype is the alleles present; phenotype is the observable trait.

3.1 B — 3:1.

3.2 (a) Square gives Tt, Tt, tt, tt . (b) Genotype 1 Tt : 1 tt ; phenotype 1 tall : 1 short.

3.3 Tt — a short offspring is tt , so it received a t from the tall parent, which must therefore carry a t .